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(54) Fastener with polymer-coated shank

Befestigungselement mit polymerbeschichtetem Schaft

Elément de fixation avec tige revêtue de polymère

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(73) Proprietor: **ILLINOIS TOOL WORKS INC.**
Glenview, Illinois 60025-5811 (US)

(72) Inventors:
- **Kish, Frederick A.**
  Wheeling, Illinois 60090 (US)
- **Ekcmann, Elizabeth J.**
  Chicago, Illinois 60645 (US)
- **Shelton, Lawrence S.**
  Morton Grove, Illinois (US)

(74) Representative: **Rackham, Stephen Neil**
GILL JENNINGS & EVERY,
Broadgate House,
7 Eldon Street
London EC2M 7LH (GB)

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Description

Fasteners of various configurations are known for fastening relatively thick workpieces, such as boards made of plywood or plasterboard, to various substrates, such as metal framing members, wooden framing members, and wooden underlayments. Commonly, such fasteners have elongate shanks defining axes and are designed to be axially driven by powered tools, such as pneumatically powered tools or combustion-powered tools.

A fastener having a tapered shank, a series of rings or ridges along the tapered shank, and helical grooves along the series of rings or ridges and appearing to be particularly useful for fastening a wooden board to a wooden underlayment is disclosed in Rockenfeller et al. U.S. Patent No. 4,718,802. Other fasteners of various configurations for fastening relatively thick workpieces to metal substrates having relatively thin walls are exemplified in Rosenberg U.S. Patent No. 1,912,222, von Mertens U.S. Patent No. 2,075,411, and Hayes U.S. Patent No. 3,850,073.

US-A-4964774 discloses coating a fastener with a polymeric residue produced by removing water from an aqueous dispersion of a film-forming thermoplastic predominately aliphatic polyurethane resin. It discloses that this reduces penetration force, increases withdrawal force and protects against corrosion.

According to this invention, a fastener having an elongate shank defining an axis, with an enlarged head formed at one end of the shank and a generally pointed tip formed at the other end of the shank, the shank having a ringed portion formed with annular grooves defining annular rings and with helical grooves intersecting the annular grooves and defining helical ribs, each helical groove being asymmetric with respect to a plane comprising the axis defined by the shank; is characterised in that the tip is frusto-conical and has a rounded end, in that the helical grooves are deeper than the annular grooves, and in that the shank has a cylindrical land between the ringed portion and the tip and between the ringed portion and the head.

This invention provides an improved fastener, which is useful for fastening a workpiece having a given thickness, such as a wooden, plywood, or plasterboard workpiece, to a metal substrate having a thinner wall, such as a steel framing member, and secondarily for fastening such a workpiece to a wooden substrate, such as a wooden framing member or a wooden underlayment. The improved fastener may be readily adapted to be axially driven by a powered tool, such as a pneumatically powered tool or a combustion-powered tool.

Preferably, substantially all of the shank is coated with a polymeric material, preferably thermoset, to resist corrosion, to improve ease of driving the fastener, and to increase holding power of the fastener when driven through a wooden, plywood, or plasterboard workpiece and then through a steel framing member. Substantially all of the fastener, as a whole, may be thus coated.

Preferably, the polymeric material is selected from a group that has a softening point that does not exceed the temperature that the fastener reaches when driven. More preferably, the polymeric material is selected from a group that has a softening point that is substantially similar to the temperature that the fastener reaches when driven. The polymeric material flows upon penetration to increase holding power of the fastener, as when the fastener is driven through a wooden, plywood, or plasterboard workpiece and then through a steel framing member.

In some applications, the temperature that the fastener reaches when driven has been measured as between 120° and 150° F (55°C and 70°C). Herein, the softening point refers to the glass transition temperature (T_g) of the polymeric material.

Preferably, the fastener is heat-treated, zinc plated, and chromate-coated, and substantially all of the shank is further coated with the polymeric material. Substantially all of the shank or substantially all of the fastener, as a whole, may be thus coated with the polymeric material.

Particular embodiments of fasteners in accordance with this invention will now be described with reference to the accompanying drawings, in which:-

Figure 1 is a fragmentary, perspective, partly cut away view of a building assembly comprising a workpiece having a given thickness, namely a wooden board, a metal substrate having a thinner wall, namely a metal framing member, and a fastener constituting a preferred embodiment of this invention. As shown in Figure 1, the fastener has an elongate shank having a ringed portion;

Figure 2, on an enlarged scale, is a sectional view taken along line 2-2 of Figure 1, in a direction indicated by arrows;

Figure 3, on a further enlarged scale, is a sectional view taken along line 3-3 of Figure 2, in a direction indicated by arrows; and

Figure 4 is a sectional view similar to Figure 3 but showing an alternative configuration of the helical grooves of the ringed portion of the fastener.

As shown in Figure 1, a building assembly comprises a relatively thick board 10, a metal framing member 12 having a relatively thin wall 14 and two relatively thin flanges 16 extending normally from the relatively thin wall 14, and a fastener 20 constituting a preferred embodiment of this invention.

The board 10 may be made from wood, plywood, or plasterboard. The framing member 12 may be made from galvanized steel. The fastener 20 may be made from 1030 carbon steel wire, heat-treated to a core hardness of 40 to 45 Rockwell C and to a surface hardness of 42 to 50 Rockwell C, zinc-plated, and chromate-coated.

The fastener 20 has an elongate shank 22 defining an axis, an enlarged head 24 formed at one end of the shank 22 and chamfered where the head 24 faces the shank 22, and a generally pointed tip 26 formed at the other end of the shank 22. Preferably, as shown, the tip 26 is frusto-conical except for a rounded end 28. Herein, it is convenient to regard the shank 22 as including the tip 26.

The shank 22 has a ringed portion 30 formed with a series of annular grooves 32 and a series of annular rings 34 and is smooth and generally cylindrical between the ringed portion 30 and the generally pointed tip. Where the annular grooves 32 are deepest, the annular grooves 32 define an imaginary cylinder. The annular rings 34 are spaced axially from one another by the annular grooves 32. Where the annular rings 34 are largest, the annular rings 34 define an imaginary cylinder. Thus, the annular rings 34 have a uniform, outer diameter. Each annular ring 34 has a frusto-conical, leading surface 36 facing toward the tip 26 and defining a comparatively small, acute angle relative to the axis and a frusto-conical, trailing surface 38 facing toward the head 24 and defining a comparatively large, acute angle relative to the axis.

Each annular groove 32 may be rounded at a small radius where the frusto-conical surfaces bounding such groove 32, namely the leading surface 36 of one such ring 34 and the trailing surface 38 of the next ring 34 in the axial direction of the tip 26, would intersect if such annular groove 32 were not rounded. Each annular ring 34 may be rounded at a small radius where the leading surface 36 of such ring 34 and the trailing surface 38 of such ring 34 would intersect if such annular ring 34 were not rounded.

The ringed portion 30 has a circumferential array of helical grooves 40 intersecting the annular grooves 32 and defining a circumferential array of helical ribs 42 intersecting the annular rings 34. Each helical rib 42 has a rounded crest 44, which is tangent with the imaginary cylinder defined by the annular rings 34, where such helical rib 42 is largest. Each helical groove 40 has a rounded valley 46, which is tangent with the imaginary cylinder defined by the annular grooves 32, where such helical groove 40 is deepest.

Preferably, as shown in Figure 3, each helical groove 40 taken in cross-section is symmetrical with respect to a plane comprising the axis defined by the shank 22 and intersecting such helical groove 40 where such helical groove 40 is deepest. Alternatively, as shown in Figure 4, each helical groove 40 taken in cross-section is asymmetrical with respect to a plane comprising the axis defined by the shank 22 and intersecting such helical groove 40 where such helical groove 40 is deepest.

After the fastener 20 has been heat-treated, zinc-plated, and chromate-coated, substantially all of the shank 22 or substantially all of the fastener 20, as a whole, is coated with a polymeric material to resist corrosion, to improve ease of driving the fastener 20, and to increase holding power of the fastener 20, as when the fastener 20 is driven through a wooden, plywood, or plasterboard workpiece, such as the board 10, and then through a steel framing member, such as the framing member 12. Although is sufficient for substantially all of the shank 22 (but not the head 24) to be so coated with the polymeric material, it is preferable for substantially all of the fastener 20, as a whole, to be so coated with the polymeric material. It has been measured that the exterior temperature of the shank 22 upon penetration of the substrate can reach a range of approximately 120° to 150° F (55°C to 70°C). Suitable polymeric materials have a softening point (T_g) in that range, so that they soften and flow upon penetration and re-harden in a slightly different orientation. This both aids in ease of driving and increases holding power. Both thermoplastic and thermoset materials have been found to be thus suitable.

A polyester-based, thermoset material is a suitable coating material, as exemplified by Corvel Stardust Silver No. 23-9082 (trade mark) polyester [poly(ethylene terephthalate)] powder coating, which can be electrostatically applied and which is available commercially from Morton International Powder Coatings of Reading, Pennsylvania. An acrylic-based, thermoplastic material is a suitable coating material, as exemplified by Maincote PR-71 (trade mark) waterborne acrylic resin, which can be applied by spraying or dipping and which is available commercially from Rohm & Haas Company of Cleveland, Ohio. An epoxy-based, thermoset material is a suitable coating material, as exemplified by Evlast Epoxy Powder Coatings, 2000 Series (trade mark), which can be electrostatically applied and which are available commercially from Evtech (a Kodak Company) of Charlotte, North Carolina.

The polymeric coating may be one of the polyester based or epoxy-based coatings disclosed in European Patent Application No. 94306571.4 published as EP-A-0676249.

As shown in Figure 2, the fastener 20 is driven through the relatively thick board 10 and through the relatively thin wall 14 so that the head 24 bears against and is countersunk partially into the board 10 and so that the tip 26 and the shank 22 form, from the wall 14, a generally annular lip 70 projecting toward the tip 26 and so that the lip 70 is disposed around the shank 22. Desirably, the polymeric material coating the shank 22 softens as the shank 22 penetrates the wall 14 and re-hardens, so as to produce a mechanical and/or adhesive seal.

The fastener 20 may be alternatively used to fasten a board, such as the board 10, to a wooden substrate (not shown) that may be as thick as or thicker than the board being fastened to the wooden substrate.

Claims

1. A fastener (20) having an elongate shank (22) defining an axis, the fastener (20) having an enlarged head (24) formed at one end of the shank (22) and a generally pointed tip (26) formed at the other end of the shank (22), the shank (22) having a ringed portion (30) formed with annular grooves (32) defining annular rings (34) and with helical grooves (40) intersecting the annular grooves (32) and defining helical ribs (42), each helical groove (40) being asymmetric with respect to a plane comprising the axis defined by the shank (22); characterised in that the tip (26) is frusto-conical and has a rounded end (28), in that the helical grooves (40) are deeper than the annular grooves (32), and in that the shank (22) has a cylindrical land between the ringed portion (30) and the tip (26) and between the ringed portion (30) and the head (24).

2. A fastener (20) according to claim 1, wherein the helical grooves (40) are all of equal depth and parallel to one another.

3. A fastener (20) according to claim 1 or 2, wherein the helical ribs (42) have rounded crests (44) and/or wherein the helical grooves (40) are rounded where deepest.

4. A fastener (20) according to any one of the preceding claims, wherein substantially all of the shank (22) is coated with a polymeric material to resist corrosion, to improve ease of driving the fastener (20), and to increase holding power of the fastener (20).

5. A fastener (20) according to claim 4, wherein substantially all of the shank (22) is coated with a thermoplastic or thermoset material.

6. A fastener (20) according to claim 4 or 5, wherein substantially all of the shank (22) is coated with a polyester-based material, an acrylic-based material, or an epoxy-based material.

7. A fastener (20) according to claim 4, 5 or 6, wherein the polymeric material flows upon penetration of the fastener (20) to increase holding power of the fastener.

8. A fastener (20) according to claim 7, wherein the polymeric material has a softening point that does not exceed or is substantially similar to the temperature that the fastener reaches when driven.

9. A fastener (20) according to any one of the preceding claims, which is formed from carbon steel and is heat treated, zinc plated, and chromate coated.

Patentansprüche

1. Befestigungselement (20) mit einem länglichen Schaft (22), welcher eine Achse definiert, wobei das Befestigungselement (20) einen vergrößerten Kopf (24) aufweist, welcher an einem Ende des Schaftes (22) gebildet ist, und eine im Allgemeinen zugespitzte Spitze (26), welche an dem anderen Ende des Schaftes (22) gebildet ist, wobei der Schaft (22) einen beringten Bereich (30) aufweist, welcher mit ringförmigen Nuten (32) ausgestattet ist, welche ringförmige Kreisringe (34) definieren, und mit wendelförmigen Nuten (40), welche die ringförmigen Nuten (32) kreuzen und wendelförmige Rippen (42) definieren, wobei jede wendelförmige Nut (40) asymmetrisch zu einer Ebene ist, welche die durch den Schaft (22) definierte Achse enthält; dadurch gekennzeichnet, daß die Spitze (26) kegelstumpfförmig ist und ein abgerundetes Ende (28) hat, daß die wendelförmigen Nuten (40) tiefer sind als die ringförmigen Nuten (32), und daß der Schaft (22) einen zylinderförmigen Stegbereich zwischen dem beringten Bereich (30) und der Spitze (26) und zwischen dem beringten Bereich (30) und dem Kopf (24) aufweist.

2. Befestigungselement (20) nach Anspruch 1, bei welchem die wendelförmigen Nuten (40) alle von gleicher Tiefe und parallel zueinander sind.

3. Befestigungselement (20) nach Anspruch 1 oder 2, bei welchem die wendelförmigen Rippen (42) abgerundete Kämme (44) aufweisen und/oder in welchem die wendelförmigen Nuten (40) an ihrer tiefsten Stelle abgerundet sind.

4. Befestigungselement (20) nach einem der vorhergehenden Ansprüche, bei welchem im Wesentlichen der gesamte Schaft (22) von einem Polymermaterial überzogen ist, um korrosionsbeständig zu sein, um das Antreiben des Befestigungselementes (20) zu erleichtern, und um die Haltekraft des Befestigungselementes (20) zu verstärken.

5. Befestigungselement (20) nach Anspruch 4, bei welchem im Wesentlichen der gesamte Schaft (22) von einem thermoplastischen oder thermisch ausgehärtetem Material überzogen ist.

6. Befestigungselement (20) nach Anspruch 4 oder 5, bei welchem im Wesentlichen der gesamte Schaft (22) von einem Material auf Polyesterbasis, Acrylharzbasis oder Epoxy-harzbasis überzogen ist.

7. Befestigungselement (20) nach Anspruch 4, 5 oder 6, bei welchem das Polymermaterial beim Eindringen des Befestigungselementsmittels (20) fließt, um die Haltekraft des Befestigungselementes zu

verstärken.

8. Befestigungselement (20) nach Anspruch 7, bei welchem das Polymermaterial einen Erweichungspunkt hat, welcher die von dem Befestigungselement beim Eintreiben erreichte Temperatur nicht überschreitet oder im Wesentlichen ähnlich dieser ist.

9. Befestigungselement (20) nach einem der vorhergehenden Ansprüche, welches aus Kohlenstoffstahl gebildet ist und wärmebehandelt, zinkplattiert und chromüberzogen ist.

Revendications

1. Attache (20) présentant une tige allongée (22) définissant un axe, l'attache (20) présentant une tête agrandie (24) formée à une extrémité de la tige (22) et une extrémité globalement pointue (26) formée à l'autre extrémité de la tige (22), la tige (22) présentant une partie annelée (30) formée par des rainures annulaires (32) définissant des anneaux (34) et par des rainures hélicoïdales (40) coupant les rainures annulaires (32) et définissant des nervures hélicoïdales (42), chaque rainure hélicoïdale (40) étant asymétrique par rapport à un plan contenant l'axe défini par la tige (22); caractérisée par le fait que la pointe (26) est tronconique et présente une extrémité arrondie (28), par le fait que les rainures hélicoïdales (40) sont plus profondes que les rainures annulaires (32) et par le fait que la tige (22) présente une partie lisse cylindrique entre la partie annelée (30) et la pointe (26) et entre la partie annelée (30) et la tête (24).

2. Attache (20) selon la revendication 1, dans laquelle les rainures hélicoïdales (40) sont toutes d'égale profondeur et sont parallèles entre elles.

3. Attache (20) selon la revendication 1 ou 2, dans laquelle les nervures hélicoïdales (42) présentent des crêtes arrondies (44) et/ou dans laquelle les rainures hélicoïdales (40) sont arrondies là où elles sont les plus profondes.

4. Attache (20) selon l'une quelconque des revendications précédentes, dans laquelle la presque totalité de la tige (22) est revêtue d'un matériau polymère permettant de résister à la corrosion, de faciliter la pose de l'attache (20) et d'augmenter la force de fixation de l'attache (20).

5. Attache (20) selon la revendication 4, dans laquelle la presque totalité de la tige (22) est revêtue d'un matériau thermoplastique ou thermodurcissable.

6. Attache (20) selon la revendication 4 ou 5, dans laquelle la presque totalité de la tige (22) est revêtue d'un matériau à base polyester, un matériau à base acrylique ou un matériau à base époxy.

7. Attache (20) selon la revendication 4, 5 ou 6, dans laquelle le matériau polymère coule lors de la pénétration de l'attache (20) afin d'augmenter la force de fixation de l'attache.

8. Attache (20) selon la revendication 7, dans laquelle le matériau polymère présente un point de ramollissement qui ne dépasse pas ou est sensiblement égal à la température atteinte par l'attache lors de sa pose.

9. Attache (20) selon l'une quelconque des revendications précédentes, qui est formée à partir d'acier au carbone et reçoit un traitement thermique, est plaquée au zinc et revêtue de chromate.

FIG. 1

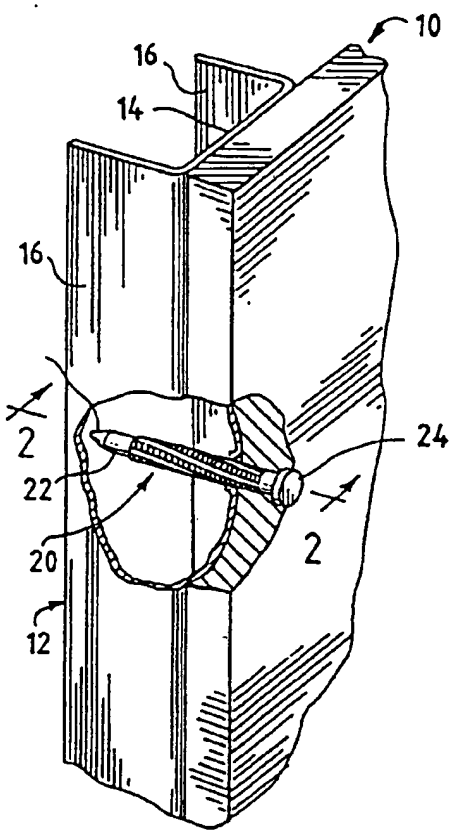

FIG. 3

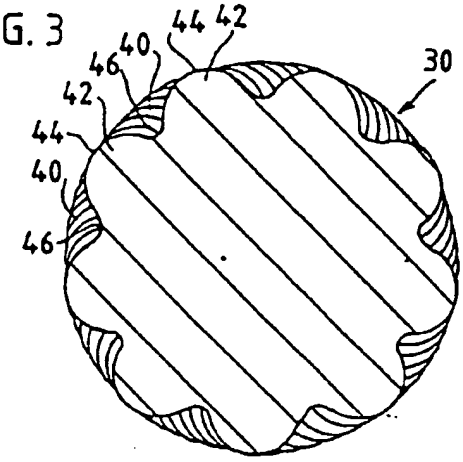

FIG. 4

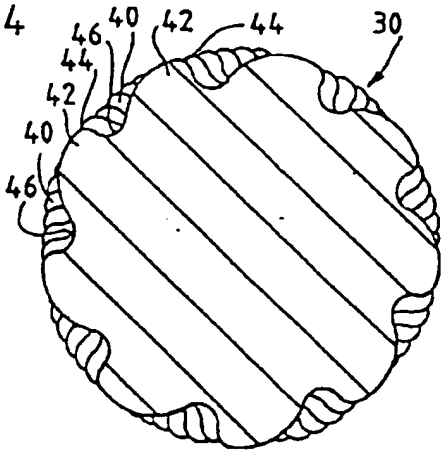

FIG. 2